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Spaceport News

John F. Kennedy Space Center - America's gateway to the universe

CRS-1 restores US resupply capability

By Steven Siceloff
Spaceport News

SpaceX is set to launch the first of a dozen operational missions for NASA to deliver more than 1,000 pounds of supplies to the International Space Station on Oct. 7. Launch time is 8:35 p.m. from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida, just a few miles south of the space shuttle launch pads. The spacecraft will be joined to the station three days later.

The flight, known as Commercial Resupply Services-1 (CRS-1) will launch and perform the same rendezvous with the station as a previous SpaceX craft.

The SpaceX Dragon capsule will ride into space on the strength of the company's Falcon 9 rocket and the booster's nine first stage kerosene- and oxygen-powered Merlin engines. The Falcon 9's second stage uses a single Merlin engine to boost the Dragon into its final orbit.

CLICK ON PHOTO *NASA/Ben Smegelsky*

SpaceX technicians rotate a Dragon spacecraft for mating with its Falcon 9 launch vehicle Sept. 30.

Eleven minutes after launch, when the Dragon capsule is safely in orbit, a pair of solar arrays will deploy from the sides of the Dragon and controllers on Earth will begin testing rendezvous sensors.

The mission is similar to the demonstration flight in May when a Dragon was grappled by the station's robotic arm to complete the first rendezvous and berthing by a private spacecraft at the space station.

The SpaceX craft will spend about three weeks connected to the station, then it will be released to return to Earth.

A major difference for this mission is that the Dragon will be

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Celebration honors rich 50-year history

By Linda Herridge
Spaceport News

The massive, white Saturn V rocket suspended from the ceiling of the Apollo/Saturn V Center, served as the backdrop for celebration, Sept. 22, to mark Kennedy Space Center's 50th Anniversary and the achievements of the last five decades.

The gala's theme, "Celebrating the Past and Preparing for the Future," was fitting as nearly 650 current and former NASA civil service and contractor employees, dignitaries and guests mingled, reminisced about days past and reconnected with colleagues from the Mercury, Gemini, Apollo and Space Shuttle Programs. They also attended to hear about the center's next chapter in spaceflight.

The event was presented by Kennedy and the National Space Club Florida Committee (NSCFC).

Master of Ceremony Jim Banke, the host of Space Talk on WMMB-AM, welcomed guests to the celebration.

"Let's take a few moments to honor the rich history and promising future of this great national asset that is so important, and continues to be important, to all of us here tonight," Banke said.

NSCFC Chairman Steve Griffin announced that the organization's Florida National Defense Space Award would be renamed the Forrest McCartney Memorial Florida National Defense Space Award to honor the late Gen. McCartney who was Kennedy's director from 1986 to 1991.

"I cannot think of a better place to celebrate 50 years of Kennedy Space Center than here at the Saturn V facility, under this phenomenal rocket," said Kennedy Director Robert Cabana.

"All of the centers play a critical role in NASA's success, but nowhere else does it come together like it does here at Kennedy," Cabana said. "This team has seen a lot in the last 50 years and we've contributed to great successes at NASA."

Included in these successes, Cabana said, were men on the moon, the first launch of the space shuttle on its own amazing 30-year history, the phenomenal achievement of the International Space Station, the Hubble Space Telescope, and the Curiosity rover on Mars.

"Throughout those 50 years, there's been one common theme, and that's an insatiable desire to explore, to send humans and robotic spacecraft beyond the confines of

See **GALA**, Page 6

Inside this issue...

Significant steps made toward Atlantis display

By Linda Herridge
Spaceport News

Inside Orbiter Processing Facility-2 at Kennedy Space Center, Tim Keyser, the midbody mechanical lead with United Space Alliance (USA), and Ray Propst, USA Atlantis flow manager, watched as space shuttle Atlantis' two 60-foot-long payload bay doors were closed for the final time Sept. 20.

"It's a proud moment for me helping to prepare this orbiter for display," Keyser said. "It doesn't get any better than this."

Propst said, "It's an honor to work with these folks, who continue to skillfully perform these complex tasks in spite of the obvious distractions."

During shuttle missions, the payload bay doors were controlled from the flight deck. But since the final power down of Atlantis occurred on Dec. 22, 2011, the operation to close the doors would have to be accomplished a different way.

In his role as move director for the Atlantis payload bay door closure operation, Keyser carefully monitored all of the activities and gave the "go" to close the doors. Bob Emerson, a USA mechanical engineer used the payload retention latch control box, which was connected to Atlantis' door drive motors, to begin the process of slowly closing the left, or portside door, and then the right, or starboard door.

NASA/Jim Grossmann

The right payload bay door closes on space shuttle Atlantis as both payload bay doors were closed for the final time on Sept. 20. During the course of its 26-year career, Atlantis spent 307 days in space during 33 missions.

"I'm looking forward to seeing how Atlantis is going to look on display," Emerson said. "I hope to finish out the shuttle program here and move on to be part of NASA's next space exploration program."

The entire process took only about an hour, with the actual closing of both doors taking under two minutes.

Technicians on platforms at both ends of the payload bay doors used speed wrenches in gear boxes located on Atlantis to lock the doors in place. Another technician slowly was moved along in a bridge bucket above Atlantis to lock the centerline latches in place.

Closing the payload bay doors is part of NASA's Transition and Retirement work on the remaining space shuttle at Kennedy.

NASA Flow Director for Orbiter Transition and Retirement Stephanie Stilson said preparations have been going extremely well and the significant work on Atlantis is completed.

"Closure of Atlantis' payload bay doors is one of the significant final milestones in order to prepare Atlantis for its move to the Kennedy Space Center Visitor Complex," Stilson said. "We are always proud to achieve a milestone on schedule, but it also is sad that this was the last time our team performed this task."

According to Propst, the yellow strongbacks on the payload bay doors will be removed, a portion of them will be modified, and then reattached to the payload bay doors to support their reopening for display at the visitor complex.

On Nov. 2, Atlantis will be transported atop the Orbiter Transport System along Kennedy's roadways en route to the visitor complex where it will be housed until the display facility is completed.

"We're staying focused on getting Atlantis safely to the visitor complex," Keyser said.

Including the final shuttle mission, STS-135, Atlantis traveled nearly 126 million miles, orbited the Earth 4,848 times, and carried 207 astronauts into space along with several components to help construct the International Space Station.

Atlantis spent 307 days in space on 33 missions during its 26-year career.

NASA/Jim Grossmann

United Space Alliance technicians install a television camera in the payload bay of the space shuttle Atlantis on Sept. 13. The orbiter is undergoing final preparations for display.

NASA/Jim Grossmann

United Space Alliance technicians remove the two external fuel tank doors from the space shuttle Atlantis in bay 2 of the Orbiter Processing Facility at Kennedy Space Center on Sept. 12. The orbiter is undergoing final preparations for display at the Kennedy Space Center Visitor Complex. For more on other Transition and Retirement activities of Atlantis, click on the photo.

NASA/Cory Huston

NASA's Commercial Crew Program (CCP) hosts a Certification Products Contract (CPC) pre-proposal conference on Sept. 19 to inform prospective companies of the recently released request for contract proposals and updates to the certification requirements for missions to the International Space Station (ISS). From left are Ed Mango, CCP's program manager; Steve Janney, CPC contracting officer; Maria Collura, program certification manager; Tom Simon, CPC Evaluation Team chair; Brent Jett, CCP deputy program manager; and Kathy Lueders, manager of the ISS Transportation Integration Office.

Common ground key to certifying commercial systems

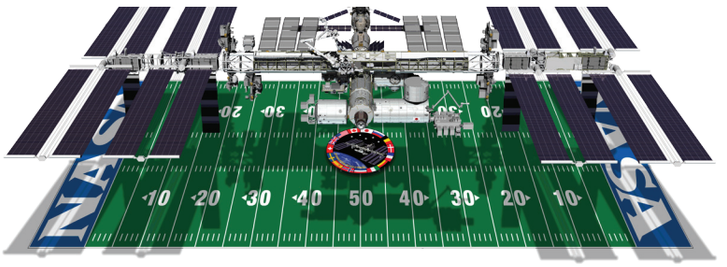
By Rebecca Regan
Spaceport News

NASA managers and aerospace industry representatives met Sept. 19 for a chance to discuss the request for proposals that will begin NASA's certification process for integrated crew transportation systems. This certification process will help NASA to eventually purchase service missions to fly astronauts to and from the International Space Station.

During the Certification Products Contract (CPC) pre-proposal conference at Kennedy Space Center, commercial crew and space station program officials made presentations and answered industry questions about the two-phase acquisition strategy the agency is taking to certify these new systems to meet its crew transportation needs no later than 2017.

"Why is this (CPC) important?" asked Maria Collura, program certification manager. "It reduces the risk for us as we enter Phase 2 and also gives us confidence in enabling the readiness for services as soon as possible."

Beginning in February 2013 when awards are anticipated, Phase 1, called CPC, will allow NASA to work with CPC contractors to establish critical systems engineering and safety tools and certification plans so that Phase 2 can be spent actually building, verifying and validating the systems. It will be up to the companies to decide how they prove their systems are safe enough to fly to low Earth orbit, but the agency will certify the systems through the use of this phased contract prior to allowing missions crewed by NASA astronauts.



NASA/Jim Grossmann

The International Space Station, which is about the size of a football field, allows crew members to conduct experiments in four areas: human health and exploration, technology testing for enabling future exploration, research in basic life and physical sciences, and earth and space science.

"We believe this will benefit both parties so that we can move forward together into Phase 2 on common ground," said Tom Simon, chair of the CPC Evaluation Team. "It's very important to agree on what's required for a NASA certification and to have common expectations so that when the plans are executed we can focus on determining if the results meet the criteria defined in the plans."

Up to this point, NASA's Commercial Crew Program (CCP) and its industry partners have been operating under Space Act Agreements. That strategy has continued to advance the development of systems for the country as a whole through NASA's Commercial Crew Development Rounds 1 and 2 and the newly awarded Commercial Crew Development Integrated Capability (CCiCap). CCP's phased acquisition will allow NASA and industry to iron out how systems in development could meet all of NASA's safety and performance requirements for crewed missions to the space station.

"Just to be clear, those requirements have been locked in place for quite some time," said Ed Mango, CCP manager. "All we have been doing is updating them with clarifications and expanding our supporting information helping to make sure that they are clearer for industry to understand."

"The CPC effort is critical to defining a complete system that is safe enough to fly our astronauts to the International Space Station," Mango said.

The transition between the two phases is expected to take place in mid-2014. While both phases will be open to any company to submit a proposal, Collura said Phase 2 will build on Phase 1, and companies that are interested in receiving a contract for NASA crew transportation are encouraged to submit proposals for Phase 1.

"You absolutely will get the benefit of technical interchange and disposition, which will help prepare you for Phase 2 and actually reduce risk to both of us during that phase as well," Collura said.

"If you are a company out there who is developing a commercial crew transportation system and you're at the appropriate level of maturity in the design and development process, we want to work with you in Phase 1," said CCP's Deputy Program Manager Brent Jett. "We think it's very critical to engage with the developers of these systems in Phase 1 to disposition those products so that you can make the right decisions in your designs as you approach the critical design state and get ready to compete for Phase 2."

More information

- Questions and answers from the Pre-Proposal Conference can be found on the contract's procurement website at:
  http://procurement.jsc.nasa.gov/ccpcpc

- To learn more about NASA's Commercial Crew Program, visit:
  http://www.nasa.gov/commercialcrew

Roto system gives new spin to landing spacecraft

By Steven Siceloff
Spaceport News

A team of researchers brought a pair of scale model space capsules to the Vehicle Assembly Building (VAB) at Kennedy Space Center to try out a rotor system that could be used in place of parachutes on returning spacecraft.

The design would give a capsule the stability and control of a helicopter, but would not be powered. Instead, the wind passing over the rotors as the capsule descends would make the blades turn, a process called auto-rotation that has been proven repeatedly on helicopters but never tried on spacecraft.

"The purpose of the testing we're doing here is to study how to get the rotor starting to spin," said Jeff Hagen, an engineer at Johnson Space Center in Houston. "We're trying to build as much of that story as we can."

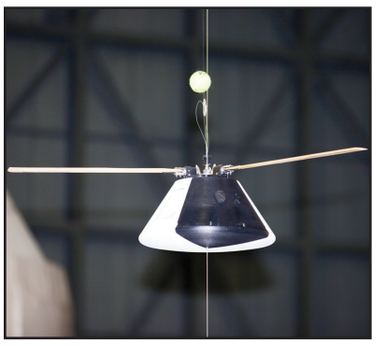
Inside the cavernous VAB, team members were spread out at different levels, Jim Meehan stood at the 16th level, about halfway up to where the two-pound model capsule hung on a line 480 feet above the concrete floor.

Holding a helicopter radio-control unit, he remotely changed the rotors' pitch and slowed the fall four times as the unpowered craft landed on a stack of foam.

"It's like running four separate tests in one drop," said Meehan, an engineer at Marshall Space Flight Center in Huntsville, Ala.

NASA/Kim Shiflett

NASA's Johnson Space Center Aerospace Engineer Jeff Hagen attaches a rotor to the top of a model capsule ahead of drop tests inside the Vehicle Assembly Building at Kennedy Space Center on Sept. 20.



NASA/Kim Shiflett

A model capsule is used for drop tests inside the Vehicle Assembly Building at Kennedy Space Center to test a rotor system landing design on Sept. 20. The design would give a capsule the stability and control of a helicopter, but would not be powered. The intent is to give real spacecraft a soft landing with enough control that they could touch down anywhere in the world, whether on a runway or parking lot. In other words, wherever a helicopter could land, a spacecraft could land, too.

The intent is to give real spacecraft a soft landing with enough control that they could touch down anywhere in the world, whether on a runway or the top of a building. In other words, wherever a helicopter could land, a spacecraft could land, too.

"You can land gently and you can land where you want. You don't have to land out in the ocean," Meehan said. "Compared to a parachute, you get a soft landing and you get a targeted landing."

The rotor concept also fits nicely with spent rocket boosters, Hagen said. Instead of throwing away the stage and its valuable engines, rotors could be built into the booster frame and unfurled as the stage descends to Earth. Just as with the capsule, the stage would be controllable the whole way down and would land softly to save the all-important engines.

One might think the blades would fold up like an umbrella on a windy day the moment they touch the airstream around the capsule, but Hagen said the airflow around the hinges would be balanced, so the blades would hold strong.

The researchers note that their work is about incorporating different elements together into something that is innovative.

"A hundred years ago, there were cameras and there were phones and there were wireless devices to send Morse code and they were all separate technologies on their own," said Les Boatright, an engineer at Kennedy. "Now you have a telephone that does all three of those things and it's a merger of technology. Well, this is taking the capsule entry technology and helicopter rotor technology and merging those in an innovative way to make something that didn't exist before out of two things that did exist before."

The development team also notes that some bombs have fins that flick open safely at high speed. The returning spacecraft could use a mechanism similar to the fins, with the difference being that the capsule's blades would start spinning almost immediately after opening. Control fins would open on the side of the capsule, too, to keep it from revolving with the blades.

According to the engineers, the testing is extremely simple compared to the high-tech evaluations that must be done before such an experimental system could be flown into space, but the analysis is critical to moving through the early phases of development to convince people it's an idea worth pursuing.

The idea is not all that new. In fact, NASA researched the concept for the Apollo capsules but opted for the parachute return for the sake of shortening development time during the moon race.

Testing of the concept will get more demanding over time, including the possibility of hauling a roto-capsule miles into the sky on a high-altitude balloon for release. And before rotors are entrusted with the lives of astronauts, designers expect to try them out on a small capsule returning fragile science samples from the space station.

For that task, which at this point cannot be done by another spacecraft since the retirement of the space shuttle, the roto-capsule could find a successful niche pretty quickly, researchers said.

Hagen said, "That's kind of a big leap from something that's a small test article to something that's on a manned system, but in between you could have something that's a small-scale sample return that's cargo only,"

Scenes Around Kennedy Space Center

CLICK ON PHOTO *NASA/Jim Grossmann*

Fresh Ideas Southeast began serving employees Oct. 1 in the Headquarters and Multi-Functional Facility cafeterias. Here, workers place their orders at Subway inside the MFF. Fresh Ideas Southeast plans to assess the needs of the workforce and make any necessary adjustments, which includes their hours of operation. Look for an in-depth look at the new services in the next issue of Spaceport News.

CLICK ON PHOTO *NASA/Randy Beaudoin, VAFB*

Technicians install the avionics shelf on the third stage of the Orbital Sciences Corp. Pegasus XL rocket Sept. 25 at Vandenberg Air Force Base in California. The rocket, which will launch the Interface Region Imaging Spectrograph, or IRIS, spacecraft is scheduled for launch from Vandenberg scheduled for next year. IRIS will open a new window of discovery by tracing the flow of energy and plasma through the chromospheres and transition region into the sun's corona using spectrometry and imaging.

CLICK ON PHOTO *NASA/Kim Shiflett*

Astronauts Mike Fossum and Cady Coleman look over a model capsule fit with rotor blades ahead of tests inside the Vehicle Assembly Building at Kennedy Space Center on Sept. 20.

CLICK ON PHOTO *NASA/Kim Shiflett*

Construction workers lower the large space-shuttle-era Level E north work platform from high bay 3 inside the Vehicle Assembly Building (VAB) at Kennedy Space Center on Oct. 2. The platform will be moved to the VAB north parking area for temporary storage. The work is part of a centerwide refurbishment initiative under the Ground Systems Development and Operations, or GSDO, Program. High bay 3 is being refurbished to accommodate NASA's Space Launch System and a variety of other spacecraft.

From **GALA**, Page 1

our home planet, in a never-ending quest to expand our knowledge of the universe," Cabana said.

But, as great as those last 50 years have been, Cabana said he truly believes that the next 50 years are going to be even better. The center is putting in place the infrastructure to send humans further into the solar system than they've ever gone before. A spaceport of the future, once science fiction, is being built, with commercial and government, crew and cargo, orbital and suborbital flights, and flights well beyond planet Earth.

"I am sure of this success, because of the quality, drive, dedication and enthusiasm of this outstanding Kennedy team," Cabana said. "We are charging into the future."

Guests were treated to a special greeting from International Space Station Expedition 33 Commander Sunita Williams.

"On behalf of astronauts everywhere, we thank you for your hard work," Williams said. "We can't wait for the future missions, where we will fly once again from Kennedy and where those missions will take us."

NASA Administrator Charlie Bolden said that for millions of our citizens, and billions of people around the world, the Kennedy Space Center is synonymous with mankind's greatest achievements in exploration of the universe.

"With retirement of the shuttle program, we stand on the cusp of a new era in spaceflight, and Kennedy is again at the center of this action," Bolden said.

"As we stand on the shoulders of 50 years of greatness here at Kennedy, I ask you to join me in looking forward to an even brighter future."

Bolden said we are not just on a mission to discover the universe. We're on a mission to discover ourselves.

"We can't forget that the purpose of space exploration is to make life better here on Earth," Bolden said.

PBS NewsHour Science Correspondent Miles O'Brien closed the program with his unique view of NASA's space program, Kennedy Space Center and its workers.

"Here you take tremendous pride in everything you do. And all of it for the right reasons," O'Brien said. "What strikes me the most is the way all of you conducted yourselves as you wrote the epilogue to an amazing epic story."

"Tonight we celebrate much more than an accident of geography. We celebrate, we venerate, the minds, the hands, the accumulated knowledge and the ingenuity that made this place great for 50 years, and will make it great for as long as we continue to go to space."

Some of Kennedy's former directors and retired workers praised the fine work accomplished at the center.

Richard Smith, Kennedy's center director from 1979 to 1986, said that Kennedy has a great history, but its true resource is the people.

Bill Parsons, center director from 2007 to 2008, was delighted to be among friends and colleagues.

"They are the true icons of this business," Parsons said. "I am so blessed that I get to be a part of this business."

Roland Norris was the lead for mechanical systems on the first manned Gemini launch. He arrived at Kennedy during the end of the Mercury program and spent 45 years at the center, working all the way through to the Space Shuttle Program, before retiring in 2003.

"It was a privilege working here during such an historic time," Norris said. "It was challenging and very rewarding. We were working with the best and finest in the country."

Wayne Owens, a design engineer, arrived at Kennedy in 1965.

"I'm here because of my love for NASA," Owens said.

NASA/Kim Shiflett

Hundreds of attendees listened to NASA Administrator Charlie Bolden during Kennedy Space Center's 50th Anniversary Gala at the Kennedy Space Center Visitor Complex Apollo/Saturn V Center on Sept. 22. The gala was coordinated by Kennedy Space Center and the National Space Club Florida Committee with the theme, "Celebrating the Past and Preparing for the Future." The event was attended by about 650 current and retired civil service and contractor workers, dignitaries, and several former Kennedy Space Center directors.

From **SPACEX**, Page 1

filled with an amount of cargo suitable for an operational mission.

The prior flight carried just enough items to prove the capsule would do its job as a cargo hauler. This time, the manifest will include a freezer for the station's scientific samples, a powered middeck locker with an experiment inside along with a variety of materials for the astronauts living and working on the space station.

The supply flight is part of NASA's Commercial Resupply Services contract, which is paying SpaceX for 12 cargo runs to the orbiting laboratory. The station also is serviced by Russian Progress cargo capsules, European-made and launched Automated Transfer Vehicles, or ATVs, and Japanese-produced H-II Transfer Vehicles, or HTVs. All the cargo ships operate without astronauts or crew members aboard.

Once the spacecraft arrive at the station, the astronauts and cosmonauts aboard unload them and fill them with used materials or unneeded equipment before releasing them.

Here, SpaceX again does something unique. The Dragons are built with heat shields to survive a plunge through the atmosphere and splashdown safely in the ocean under billowing parachutes. The other cargo craft do not carry heat shields, so they just burn up in the atmosphere.

On its return trip, the Dragon capsule will carry more than a ton of scientific samples collected during space station research, along with the freezer the samples have been stored in. Astronauts also will load used station hardware into the capsule for return to Earth where engineers can get a firsthand look at it.

A second American cargo craft also is being developed. The Orbital Sciences' Cygnus spacecraft and Antares rocket are due to make a demonstration flight later this year.

NASA

A Space Exploration Technologies, or SpaceX, Falcon 9 rocket is being prepared Sept. 30 for the company's first Commercial Resupply Services, or CRS-1, mission to send a Dragon spacecraft to the International Space Station.

Scientists mitigate dust problem for explorers

By Bob Granath
Spaceport News

One of the challenges in exploring the moon or planets is dust kicked up by engines during landing or activity on these distant worlds. Scientists in the Electrostatics and Surface Physics Laboratory at Kennedy Space Center are developing ways to mitigate this problem.

Electrodynamic dust shield, or EDS, technology is based on concepts originally developed by NASA as early as 1967 and later by the University of Tokyo. In 2003, NASA, in collaboration with the University of Arkansas at Little Rock, started development of the EDS for dust-particle removal from solar panels to be used on future missions to Mars.

Dr. Carlos Calle, lead scientist in Kennedy's Electrostatics and Surface Physics Lab, is developing instrumentation to deal with the problem of electrostatic dust phenomena during future planetary exploration missions.

"Our laboratory is now developing an electrodynamic dust shield to prevent debris from accumulating on various surfaces," Calle said.

Long-term testing is planned for an experiment being developed for launch to the International Space Station aboard a SpaceX Dragon resupply mission in 2015.

"Our payload called Electrodynamic Dust Shield for the Materials International Space Station Experiment-X, or MISSE-X, will be mounted on an external station platform to verify the effects of the space environment," he said. "The electrodynamic dust-shield experiment will contain four panels and an electronics control box. Testing will include a transparent EDS for optical systems and solar panels, two EDS panels for thermal radiators and an EDS on fabric for spacesuit dust protection.

NASA

Electrodynamic dust-shield devices are tested in a vacuum chamber during reduced gravity flights aboard one of NASA's aircraft. The simulations took place as the aircraft flew steep dives creating brief periods of gravity similar to that of the moon and Mars. When activated, 99 percent of the dust was removed from the surfaces protected by the dust shields.

"What we learn on the space station experiments," Calle said, "should allow us to be better prepared to mitigate dust problems the next time humans visit another planet."

Many of today's state-of-the-art digital, single-lens reflex cameras include a similar device to periodically vibrate, shaking dust off the light sensor that creates the photographic image. However, Calle explains the EDS does not actually vibrate.

"This technology works by creating an electric field that propagates out like the ripples on a pond," he said. "This could prevent dust accumulation on spacesuits, thermal radiators, solar panels, optical instruments and view ports for future lunar and Mars exploration activities."

Much of this research is a follow-up to lessons learned from the lunar missions of the early 1970s.

The final three Apollo lunar-landing missions included three moonwalks of up to seven-and-a-half hours. Astronauts said the soil was as fine as talcum powder and stuck to their pressure suits and helmet visors.

"Jack Schmitt said that on Apollo 17 he had to keep brushing the dust off his visor," Calle said. "By the end of the third moonwalk, his glove had so badly scratched the visor that it was difficult to see."

Harrison "Jack" Schmitt was the lunar module pilot on Apollo 17, which landed on the moon in December 1972. He and mission commander Eugene Cernan spent over three days on the lunar surface. They and other Apollo astronauts reported they were not able to leave the dust problem outside.

"On each landing mission, the Apollo crews said they tried to brush off the moon's dust," Calle said, "but a good bit of it stayed on their space suits. Once inside the atmosphere of the lunar module, it floated around where it could be inhaled. That's not a serious problem for a three-day stay, but during a three-month expedition on a lunar base, it could become a health hazard."

With the electrodynamic dust shield embedded in the fabric of future spacesuits, particles can be removed by applying an electric field to these electrodes to remove dust and also prevent its accumulation.

"So far, our testing has shown the electrodes can remove most of the dust," said Calle. "The electrodes are made from different conducting films. These thin wires are imbedded in surfaces such as fabrics and can be made transparent on clear surfaces for optical devices, windows, visors, thermal radiators or solar panels."

These applications would be helpful with the type of dust problems that affected Mars Exploration Rovers Spirit and Opportunity, which landed on the Red Planet on Jan. 4 and Jan. 25, 2004, respectively.

"Unlike the moon, Mars has an atmosphere which blew dust on to the solar panels of Spirit and Opportunity," Calle said. "Both robotic probes could have been jeopardized. Fortunately, that same atmosphere created dust devils that blew much of the dust off. This kept the rovers going."

A dust devil is a small whirlwind over land, visible as a column of dust and debris. They are not phenomena to be dependent on, and future missions may not be as fortunate, thus requiring mitigation technology.

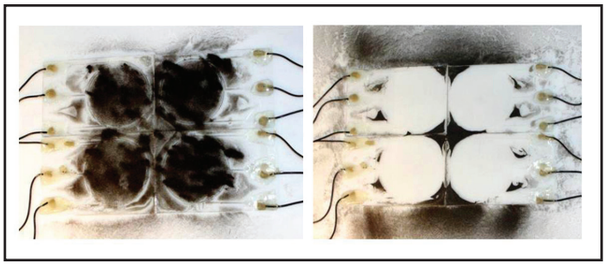
"We believe electrodynamic dust-shield devices could protect the solar panels from dust accumulation," Calle said.

Extensive testing in simulated laboratory environments and testing on a reduced-gravity flight show that high levels of dust can be removed.

"To simulate the conditions of space, our tests have been performed in both a vacuum and low gravity," said Calle. "We call it the Reduced Gravity Flight Experiment."

A vacuum chamber was flown on one of NASA's aircraft that flies steep dives, creating brief periods simulating the one-sixth Earth gravity of the moon and the Martian gravity that is about 38 percent of Earth's. Under these conditions, layers of dust were placed on materials embedded with electrodynamic dust-shield devices.

"When activated, 99 percent of the dust was removed from the surfaces protected by the dust shields," Calle said.



NASA

The image on the left shows dust-covered glass. During high vacuum testing, seen on the right, an electric field was created by the electrodynamic dust shield removing virtually all the debris.

Looking up and ahead . . .

*** All times are Eastern**

2012

Oct. 7	SpaceX Launch/Cape Canaveral Air Force Station (SLC-40): Falcon 9, Dragon C3 Launch window: 8:35 p.m.
Oct. 23	NASA Launch/Baikonur Cosmodrome, Kazakhstan: Expedition 33/34, Soyuz TMA-06M Launch window: TBD
Oct. 25	USAF Launch/Cape Canaveral Air Force Station (SLC-41): Atlas V, Orbital Test Vehicle (OTV) Launch window: TBD
Oct. 31	NASA Launch/Baikonur Cosmodrome, Kazakhstan: ISS Progress 49 Launch window: TBD
Dec. 19	NASA Launch/Baikonur Cosmodrome, Kazakhstan, Expedition 34/35, Soyuz TMA-07M Launch window: TBD
Dec. 13	NASA Launch/Cape Canaveral Air Force Station (SLC-41): Atlas V, Tracking and Data Relay Satellite-K (TDRS-K) Launch window: 11:57 p.m. to 12:37 a.m.

To watch a NASA launch online, go to **http://www.nasa.gov/ntv**.

In celebration of Kennedy Space Center's 50th anniversary, enjoy this vintage photo . . .

FROM THE VAULT

NASA file/1968

The Apollo 104 command and service modules arrived at Kennedy Space Center on Oct. 7, 1968. They were used for the second crewed Saturn V flight. The sign says, "Good luck again Jim, Dave and Rusty -- 104 opens the door," referring to astronauts James McDivitt, David Scott and Russell Schweickart, who flew on the mission.

NASA Employees of the Year

NASA

Employees of the Year are, from left, Beth Smith, Education and External Relations; Christine L. Weaver, Safety and Mission Assurance Directorate; David R. Ungar, Information Technology and Communications Services; Anton P. Kiriwas, Ground Processing Directorate; and Steven Bigos, ISS Ground Processing and Research Project Office. Not pictured are Marilyn A. Davidson, Chief Financial Office; Clifton W. Lanham, Ground Systems Development and Operations; Kelli C. Maloney, Engineering Directorate; Angel R. Lucena, Engineering Directorate; Kimberly A. Sweep, Procurement Office; Candrea K. Thomas, Public Affairs; Vicki M. Cox, Center Operations; Jorge L. Piquero, Launch Services Program; and Josephine C. Pereira, Human Resources Office.

NASA Employees of the Month: October

NASA

Employees for the month of October are, from left, Michael P. Porta, Chief Financial Office; Kelly J. Boos, Procurement Office; Nicole L. Dawkins, Engineering Directorate; Pamela K. McCoy, Launch Services Program; and David R. Bush, Center Operations. Not pictured are Cheryl A. McPhillips, Commercial Crew Program; Anthony P. Bartolone, Ground Processing Directorate; Joy "Mary" Squires, Information Technology and Communications Services; Michael D. VanHouten, Ground Systems Development and Operations; Rene Formoso, Engineering Directorate; and Nancy Bray, Public Affairs.

John F. Kennedy Space Center

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Assistant managing editor . . . . . Stephanie Covey
Editor . . . . . Frank Ochoa-Gonzales
Copy editor . . . . . Kay Grinter

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